

SCALE-UP OF DIAMOND DEPOSITION WITH MICROWAVE PLASMA CVD

Ralf Spitzl, Hildegard Sung-Spitzl

iplas innovative plasma systems gmbh, Langbaurchstr. 10 – 53842 Troisdorf, info@cyrannus.com

Keywords: Microwave plasma, PACVD, high pressure, diamond film, ultra-nano-crystalline diamond

Abstract

The scale-up of diamond CVD processes for economic production is related to growth speed and desposition area. By introducing the CYRANNUS concept (cylindrical resonator with annular slots) a new device for generation of uniform microwave plasma at higher pressure became available. That type of plasma sources combine a resonator structure (which enables high pressure operation) with a multi-antenna microwave feeding (which enables high power transfer).

SIZE VARIATION

Several sizes of plasma sources have been used for deposition of diamond and will be compared:

- A plasma source with 150mm diameter chamber size was excited with 2.45GHz microwave and has successfully been used for deposition of diamond at medium pressure. The plasma shows the shape of a sphere. Deposited <100> films showed thickness uniformity better than $\pm 3\%$ at 50mm diameter. The possible deposition diameter is larger than 100mm. High pressure deposition at 300mbar increased the growth rate up to 50 $\mu\text{m/h}$.
- An antenna scaled system with 250mm diameter chamber size was also operated at 2.45GHz and shows a discus-like shape of the plasma.
- Scaling the plasma source to a microwave frequency of 915Mhz increased the diameter of the chamber to 350mm. Such system has been used for deposition of diamond at a pressure of 60mbar hydrogen. The process and deposition temperature was controlled by the pressure of the plasma gas. The results of a 200mm wafer coating will be presented.



Figure 1. Diamond deposition with PACVD in 915MHz CYRANNUS system